BOOK REVIEW

Johnson's Taxonomy of Flowering Plants

No matter what may be said to the contrary, a knowledge of the names of plants and of their proper place in classification remains a basic essential of botanical knowledge and botanical research. The few who might deny this fail to realize that their own use of names permeates all their botanical study and that they rely on the work of others in this line even though they do not contribute to it themselves. Of late years, actual instruction in systematic botany in America has been considerably reduced, until there has become a pretty well developed appreciation of the deficiency and a desire often expressed for more and better teaching of the subject. One hindrance to this has been the lack of a suitable textbook, another the lack of experienced teachers. We can not expect a teacher without experience in systematics to be the best teacher of the subject, nor to teach it at all without a textbook to serve as a guide, while a person who has a personal knowledge of the subject can teach it without a text. Experience with plant classification usually begins with acquiring a knowledge of the local flora, and our modern Ph.D. mills neglect that phase of education to a lamentable extent. So the desire to extend the knowledge of systematic botany through the younger generation has largely failed for lack of suitable teachers and suitable texts.

In the past three years three textbooks of systematic botany have appeared in this country, and it is with the latest of these that we are now concerned.[1]

Dr. Johnson brought to his task of preparing this large volume the experiences gleaned through several years of teaching the subject. During this time he learned to distinguish between one body of facts which are of direct use to the student in acquiring a general knowledge of the subject and another body which represents the end to be attained. The first includes the principles on which classification is based, the preliminary information, mostly morphological, necessary to its comprehension, and the methods by which a plant may be placed in its proper category in the general scheme. The second includes the morphological characteristics

[1] Johnson, Arthur Monrad. Taxonomy of the flowering plants. pp. xxi + 864. 478 figures. The Century Company: New York and London, 1931. $7.50.

of the various groups and the more important plants contained in them. The first represents information which the successful student should carry with him permanently; the second a mass of statistics which are best carried in a conveniently available book of reference rather than in the student's memory. We all realize that it is beyond the power of any person to know all the hundred and fifty thousand species of flowering plants, or the thousands of genera, and we doubt if even such men as Hooker or Engler could place any plant into its proper family at sight. With most of us, lack of contact with possibly half of the three hundred families soon dims them in our memory, but every botanist should recognize at sight at least twenty-five of the larger families, excepting of course the aberrant members, which often baffle even the specialist. But if he has the general principles well in mind, and has access to a proper reference book, he should soon be able to locate any other plant in its proper group. This seems to be the goal which Dr. Johnson would reach in his teaching, and with it we are heartily in accord.

We have no doubt that one of his students will recognize without difficulty a composite, an umbellifer, a crucifer, or members of many other families at sight, no matter where he finds them, but we wonder whether that recognition will come as a result of the application of the general principles presented in the book, or by comparison of the flower with the recollection of other flowers which he has seen in his field or laboratory work in Dr. Johnson's class. For example, if a student traveling in South Africa is attracted by a handsome tree with silvery foliage, will an examination of the flower convince him that he is dealing with the Proteaceae, having a specimen of *Leucodendron* before him? As a still more difficult case, consider the family Flacourtiaceae, which contains a remarkably diverse assemblage of plants. According to Dr. Johnson, the flowers may be hypogynous, perigynous, or epigynous; the sepals 2 to 15; the petals none to 10 or more; the stamens few to many, free or united in bundles; the carpels 2 to 10. We wonder if a student can place a plant in this family accurately, or even in the order to which it belongs, and if he should guess the family, whether he can verify his guess by reference to any information about it which Dr. Johnson gives. Reference to his chart on page 150 indicates that the Parietales, to which the Flacourtiaceae belong, have sepals and separate petals. How can

the student be expected to place into this order an apetalous flacourt, of which there are many?

However, the proof of the pudding is in the eating, and we trust that a study of the textbook will give a student a more general familiarity with plant families than we have indicated by these two possible exceptions, although there are many more of the same sort which might be enumerated.

More than half of the book, 537 pages, to be exact, is devoted to a general description of the groups of angiosperms. A condensed description is given of each order, followed by a list of the families and a key to the more important ones which an American student is likely to meet. Then each family is discussed in turn, with a statement of its characters, the number of genera and species, mention of the more important genera, and often special mention of particular species. The amount of space assigned to each family is in general proportionate to its importance, measured by its size, its representation among the economic plants of the world, and its development in America. This assignment is largely a matter of opinion and deserves no criticism: personally we should not have devoted half a page to the three genera *Didiplis, Rotala,* and *Decodon* and the same amount to such an important family as the Dipterocarpaceae.

There is no doubt that the use of such a book will be chiefly in the United States, and that there is good reason for discussing the native families in more detail than those exclusively tropical. The mere fact, however, that many tropical families will be known to the average student only through the printed description is an excellent reason for demanding absolute accuracy of statement about them. Let us take for example the large and important family Malpighiaceae, which is very properly included in the author's "Key to the principal families" under the order Geraniales on page 322. There the family is keyed out as having regular flowers and carpels splitting apart at maturity; it is spelled "Malphigiaceae", which scarcely does credit to the book. Now a great many plants of the family have irregular flowers and two of the large genera (*Byrsonima* and *Bunchosia*) as well as many smaller ones have fruits which do not separate at maturity. The matter is stated correctly, to be sure, in the discussion of the family on page 335, but the key is invalidated by such an error and the student should not be required to check the accuracy of each statement by reference

to another part of the book. Turning next to page 410 and 411, we find that the Melastomataceae are very properly placed in two sections of the key, but in the latter citation are said to have usually a corona between the petals and stamens. We have dissected flowers of some hundreds of species of this family, representing practically all American genera, and do not know of a single one with a corona. Possibly the author has good authority for his statement, but a greater familiarity with the group would not have encouraged him to use the word *usually,* to say the least. We turn on to page 610, where a key to the orders of monocotyledons is presented. Such a key may serve either or both of two purposes, to give a general conspectus of the orders, or to aid the student in placing a plant. In both cases it fails. The orders Helobiae and Triuridales are placed together at the end of the dichotomy and characterized as follows: "Stamens and carpels numerous to one. *Helobieae.*" "Stamens 3-6. Carpels indefinite. Perianth of 3-8 segments. *Triuridales.*" On the same page two other important orders are separated in this wise: "Stamens varying from one to six. Carpels 1, 2, 3, or several. *Farinosae.*" "Stamens 6 or 3. Carpels 3, rarely fewer or more. *Liliiflorae.*" These certainly impress one as a distinction without a difference. In the latter case, the orders are actually separated chiefly by the nature of the endosperm, and I doubt if any one character which is not more or less recondite in nature can be found to divide the two. The Farinosae are keyed out on page 654, where four families are characterized by having 3 carpels and contrasted with two others which have carpels 2 or 3. Such a statement does not show why the families are distinguished by taxonomists nor can it help the student in locating a plant. Such examples could be multiplied considerably, but there is no use in mentioning others.

No less than 55 pages are assigned to a bibliography, including probably nearly a thousand titles, and divided into several sections according to subject. Full of errors in citation, omitting many important works, including many unimportant ones, this part of the book is certainly fearfully and wonderfully made. In the first place, it is unbalanced. A list which includes such books as Eaton's *Manual,* now of historical importance only, should certainly include other books of equal importance but now similarly antiquated. Some such works can be found but by no means all of the most important. If Ledebour's *Flora Altaica* and *Flora*

Rossica are included, why not such a monumental work as Boissier's *Flora Orientalis*? And if the *Prodromus* is mentioned, why not its continuation as the *Monographiae?* Then there is the matter of omissions. We fail to find any of Small's minor works on the flora of Florida, nor even the *North American Flora,* except an individual reference to a portion of one number, by Rydberg. The remainder of that one part was filled by a contribution of the reviewer; possibly that is a reason why we criticize the whole bibliography, but we still believe Ascherson and Graebner's *Synopsis* should have been at least mentioned. Neither do we find any mention of the *Index Kewensis,* except a citation of the fifth supplement alone, nor of the *Index Londinensis.* Furthermore, the list is simply brimming with errors, although every botanist is or should be taught that correctness of citation is always essential. Thus we find Leroy Abrams, instead of LeRoy; N. J. Anderson instead of Andersson; W. P. O. Barton, instead of W. P. C. Barton (credited with the authorship of the *Flora Cestrica*!), Walter Dean instead of Deane; Stephen Elliot instead of Elliott; W. U. Fawcett instead of W. Fawcett; S. F. Gray's Natural Arrangement of British Plants published in 1921 instead of 1821; G. J. Hooker instead of W. J. Hooker; Micheaux instead of Michaux; F. S. Milspaugh instead of C. F. Millspaugh; P. O. Standley instead of P. C. Standley; J. T. Buckholtz instead of Buchholz; Marong instead of Morong; C. C. Dean instead of Deam; Marriam instead of Merriam; even the senior botanist of the author's own university will find his name misspelled Setchel. The reader of this review must not understand that these are all the errors: anyone can find more, some exasperating, some merely amusing. H. S. Pepoon is given the authorship of *Synopsis Plantarum* in 1805, and possibly the climax is reached when we find that *Species Plantarum* was written by L. Linnaeus!

Who is to blame for such an extraordinary series of errors? One would think that every botanist could give Linnaeus the proper initial and therefore would wish to put the responsibility on the printer. But surely someone read proof and let these errors go through. Even my friend Robert W. Hegner, editor of the series, can not entirely escape responsibility. One sighs for the pen of a Fernald, to give these evidences of carelessness proper attention.

The actual information which the student needs to grasp the

classification of plants is brought together on pages 19 to 147, which read much like the old *Structural Botany* of Gray, which many botanists will still remember from their youth. It includes the external morphology and terminology of the flower, the fruit, the inflorescence, and the various vegetative organs. If these structures and organs are the sole basis of classification, then systematic botany becomes an elementary subject, adapted to freshmen, while the experience of the reviewer is that it is an advanced subject which requires considerable previous botanical training for its appreciation. Identification of plants and recognition of families or species are the elementary parts of the science and may be learned in high school, while an understanding of the whys and wherefores of classification demand much more preparation. One finds in this book nothing about the discoveries in paleobotany which throw light on modern classification, nothing about the general nature of evolution, nothing about the contribution of plant anatomy to an understanding of plant relationships.

This is not derogatory to the inclusion of so much text on gross morphology. That subject is now seldom or poorly taught in secondary schools and usually neglected completely in college; it must be presented somewhere to the student in taxonomy. Armed with such information a student can identify a plant and can understand the great number of terms used in describing it. But he can not appreciate classification unless the rudiments, at least, of all the diverse body of botanical knowledge used in developing our modern classification are known to him. He may properly acquire such information in other courses, but its application to taxonomy should be presented in the taxonomy course itself. That the author is fully aware of this situation may be seen at once from his statements on page 17.

Chapter II presents in five pages all that the author considers necessary on such important subjects as nomenclature, the concept of the genus and species, and phylogeny, and Chapter I in eleven pages sketches the historical development of classification. Both of these chapters might be considerably extended with benefit to the student.

Lastly, we come to the introduction, which goes far toward explaining the general motive of the author. Laboratory drawing, he says, is generally vastly overdone in college work. We agree with him. The field-trip should be a dignified part of the course.

We agree thoroughly. The technical terminology of taxonomy can not be eliminated. That is correct. But "phylogeny should not be made a fetish." There, in our opinion, lies the fundamental difference between an elementary course in taxonomy, suitable for students without previous botanical experience, and an advanced course. Since 1859, phylogeny has been the sole basis of every system of classification proposed. Every system is intended to represent its author's idea of the course of evolution in plants. Every person who describes a new species or a new genus does so because he wishes to express an idea of plant relationships and hence of their phylogeny. Every botanist who changes the location of a family to a new position in the general scheme does so to demonstrate his idea of its phylogeny. When Engler began his system with the Pandanaceae and Typhaceae, he did so because he thought those families stood nearest the bottom of the phylogenetic tree, and said so definitely in his summary of general principles. The whole subject consists of just two parts: first, the extension of knowledge by the discovery of hitherto unrecognized forms of plants, the "new species" of the world's flora, and second, the arrangement of all plants into an orderly sequence. The first subject is not discussed by the author at all; the second is clearly recognized by him on page 3. Theophrastus' classification into trees, shrubs, and herbs was orderly; Linnaeus' sexual system was very orderly, but neither of them is satisfactory today. The order which we seek is an expression of evolution, of phylogeny. This the author also recognizes on page 6, even though he previously deprecates it on page xi.

The system of classification which he accepts is that of Engler, with the comparatively few changes introduced by Engler and Gilg in the last edition of the *Syllabus*. He summarizes the scheme for the Dicotyledons on page 150. Turning back to page 31, we find that he also presents in tabular form the "direction of evolution in flowers" followed by the "characters of a primitive flower." Neither he nor anyone else can reconcile the position of the Piperales at the bottom of the classification with these statements; that is, he deliberately rejects a scheme based on his own ideas of phylogeny in favor of one which is not phylogenetic according to his own standards. His system is of course orderly and therefore satisfies his own definition, but as far as being phylogenetic is concerned, he might almost as well have followed Linnaeus.

It is not a question of a difference in opinion between the author and the reviewer on the course of angiospermous evolution, in which we seem to agree. It is merely a question of the importance of phylogeny in teaching. The author says that phylogeny is overdone (p. xi), that the system which begins with the Magnolias and their relatives, standing at the bottom of the series according to the author's own statements, "has the disadvantage of being rather involved and rendering it difficult to place quickly in its proper category any plant that may be in hand" (p. 11), and that "we shall find little difficulty in placing a flower" in the categories which he adopts (p. 151). The reviewer says, after teaching nineteen classes in taxonomy, that phylogeny is the ultimate end of all classification, that emphasis on phylogeny furnishes a motive to the course and lends zeal to the student, and that the principles of the Besseyan system are so easily grasped by the student that he finds relatively little difficulty in placing a plant in its proper category.

We admit that a plant can be identified with some degree of completeness by any system of classification. If that is the sole aim of a textbook, let us use the Linnaean sexual system. We maintain that phylogeny is the aim of a course in taxonomy and the basis of classification. If our contention is true, then the book before us has failed in its purpose.

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